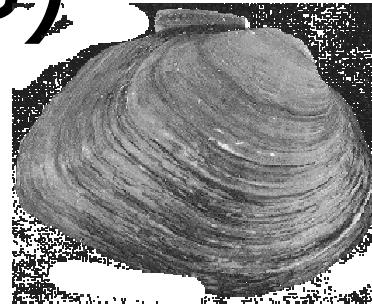


Mussels (freshwater clams)

The Canaries of Our Waters?



- Iowa once had very rich population - number and types
- Precipitous decline
- Long-lived
- Complex life cycle
- Cause of decline uncertain

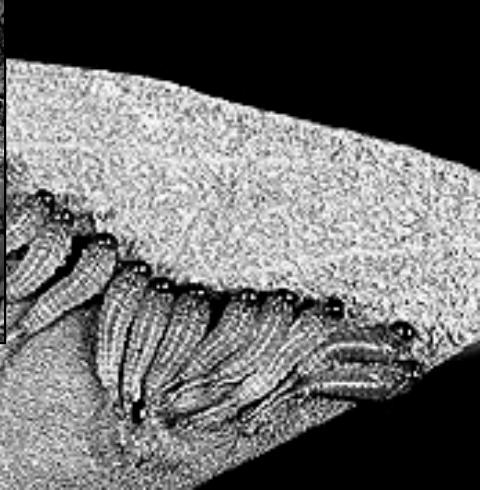


Mussels - '84 versus '98

	Frest '84 – '85	Arbuckle & Downing 1998
Number of sites	171	118
Ave. species richness/site	5.4	1.9
Maximum species richness/site	22	12
% Species absent	6%	47%
Comparative richness	---	22% = or greater; 58% lost >75% of richness

Pesticides

- Many pesticides or their breakdown products detected in water
- Amounts typically below known levels of concern



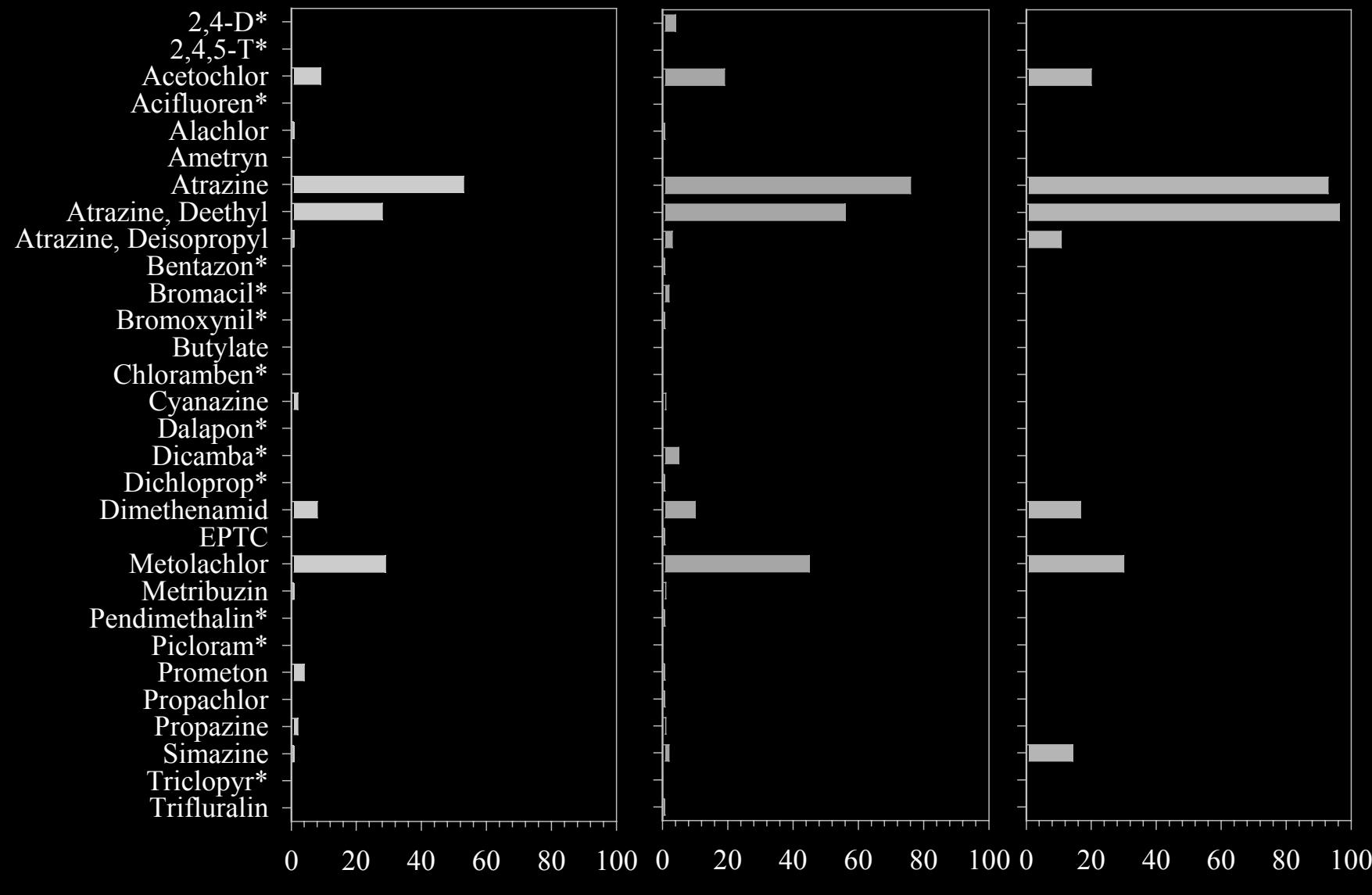
Detection Frequency of Herbicides

Streams Statewide

2000

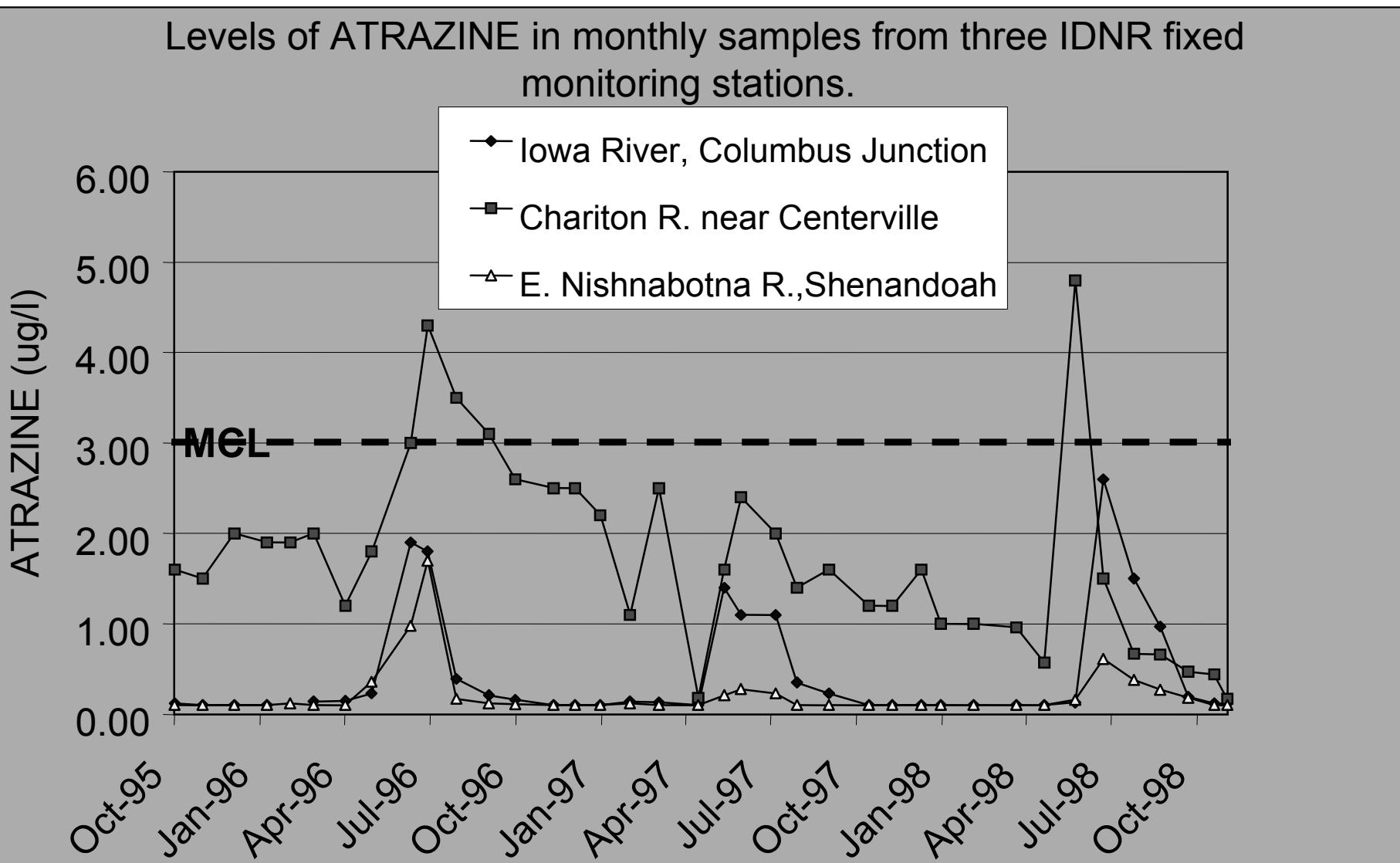
2001

2002



Pesticides

Sometimes exceed drinking water standards

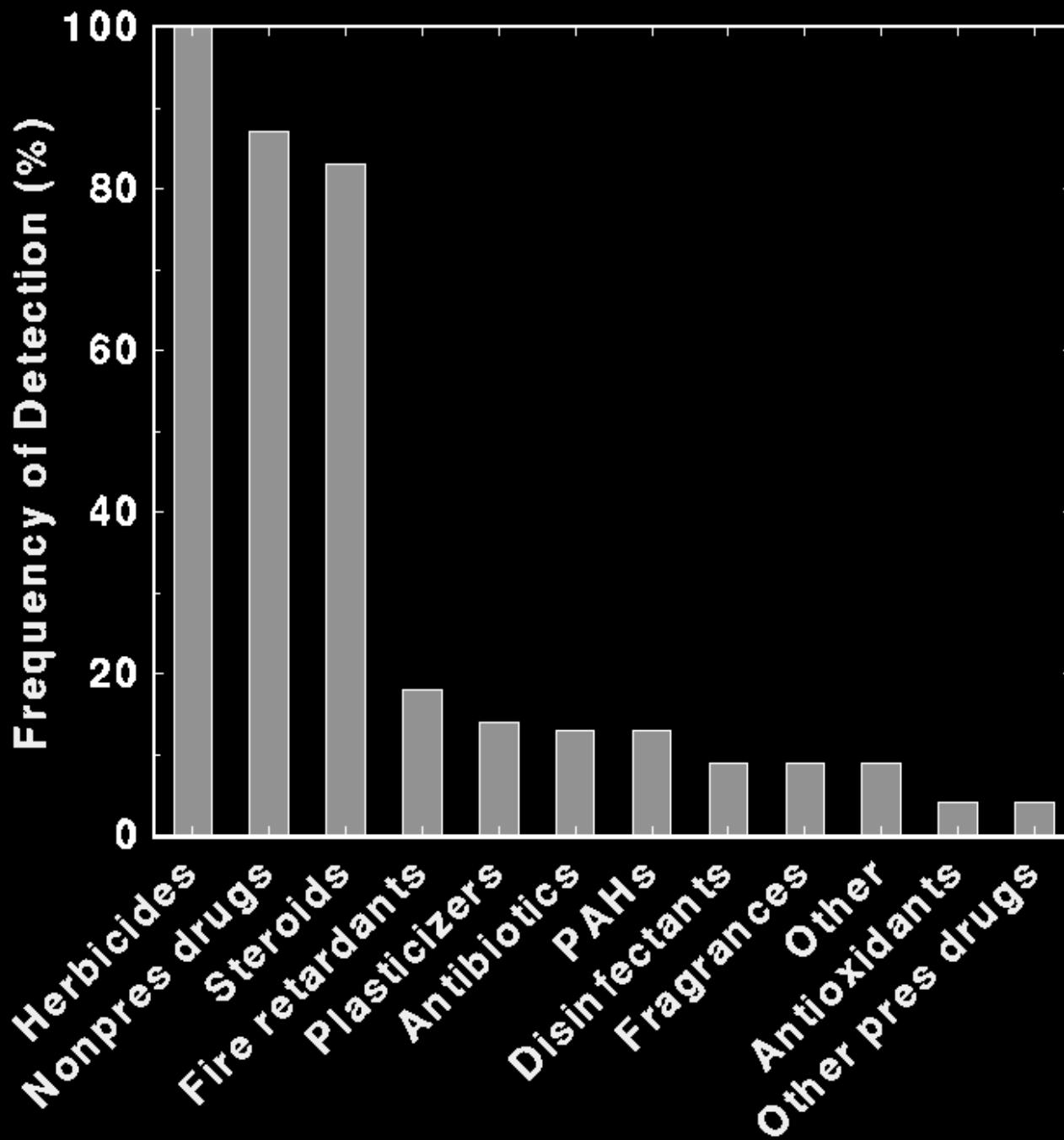


Antibiotics and Other Compounds

- Minute amounts often found
 - Antibiotics - humans, animals
 - Synthetic compounds
 - Manufacturing chemicals
 - Birth control products, etc.
- Antibiotic resistant bacteria
- Some synthetics may affect human and animal endocrine systems
- More research needed



Detection by Chemical Category



Most waters contain some amount of fecal material

- Municipal wastewater
- Inadequate “septics”
- Wildlife
- Animals and manure

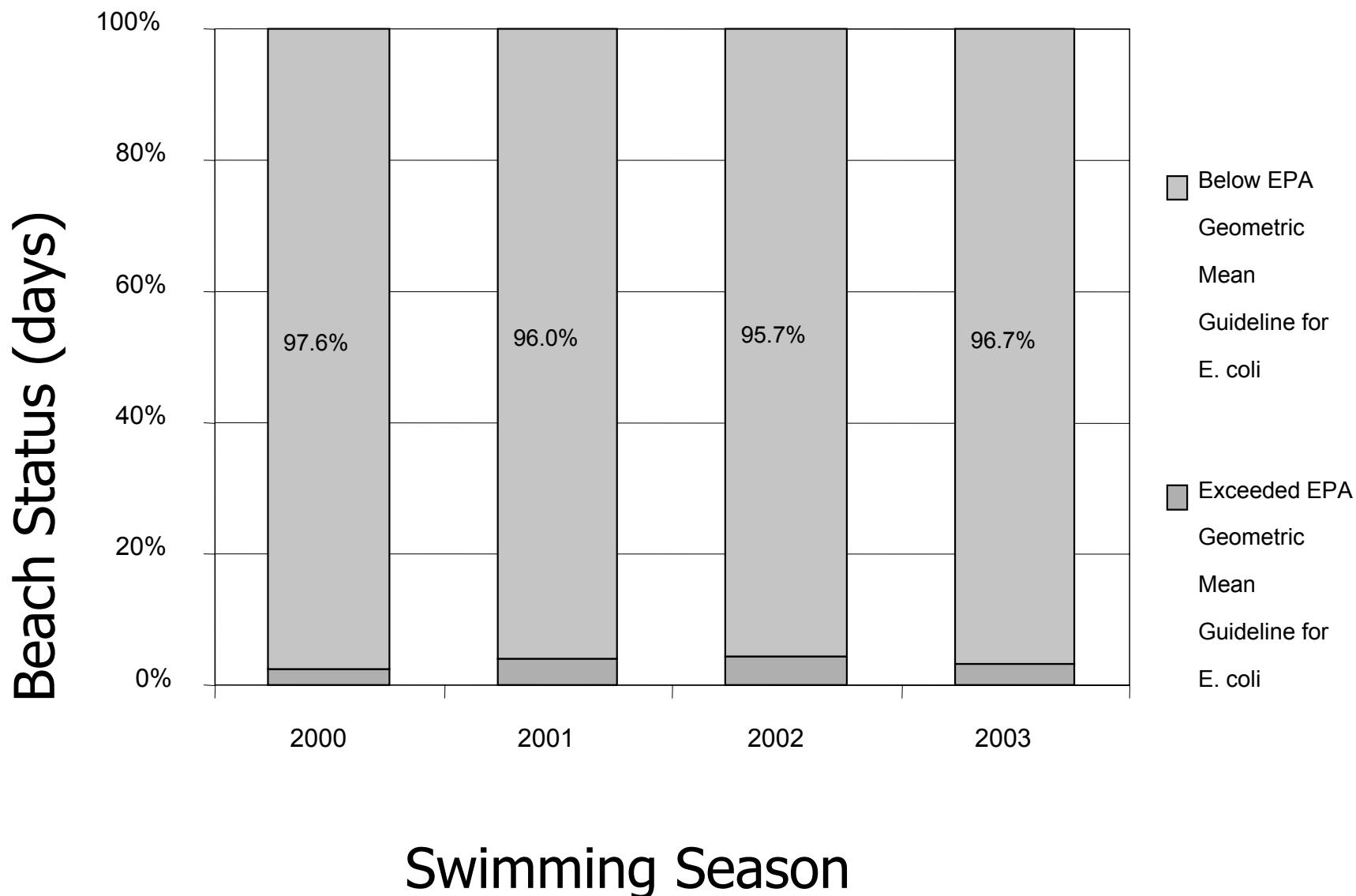


Beaches



- State beaches monitored for bacteria
- Most safe for swimming
- State park beaches exceed standards less than 4% of the time

Status of State Beaches



Iowa's aquatic populations

- Biological surveys used to measure aquatic health
- Fish and aquatic “bugs”
- Overall aquatic health of our waters is OK, but not great

2002 Random Sampling Project

51 Stream/River Sites

Fish Index of Biological Integrity



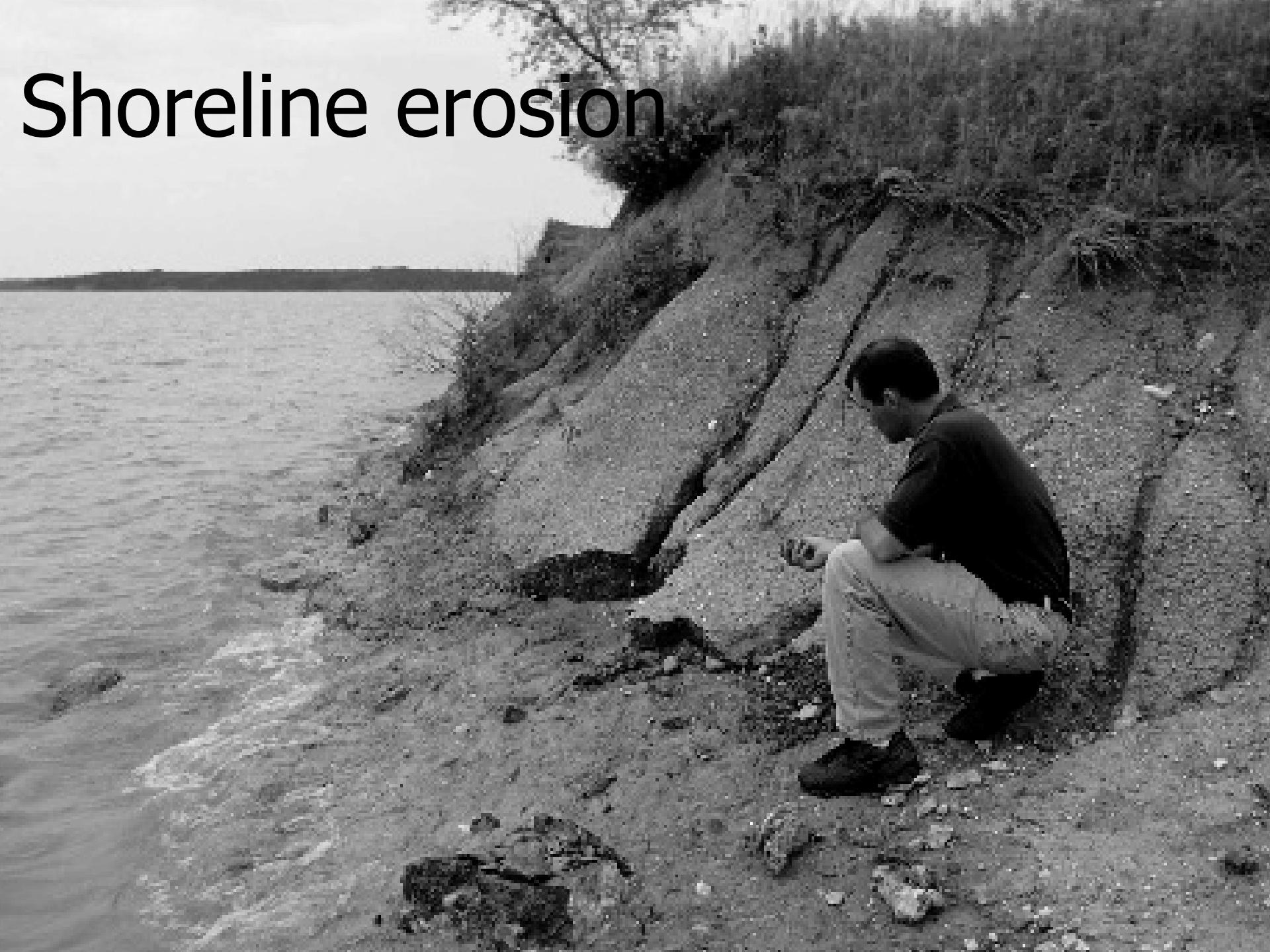
Soil erosion is still a major water quality problem

- Urban and agricultural
- Upland sheet and rill
- Gully erosion

Stream bank erosion



Shoreline erosion



Soil erosion = muddy waters



Our rivers and lakes have very high levels of nutrients

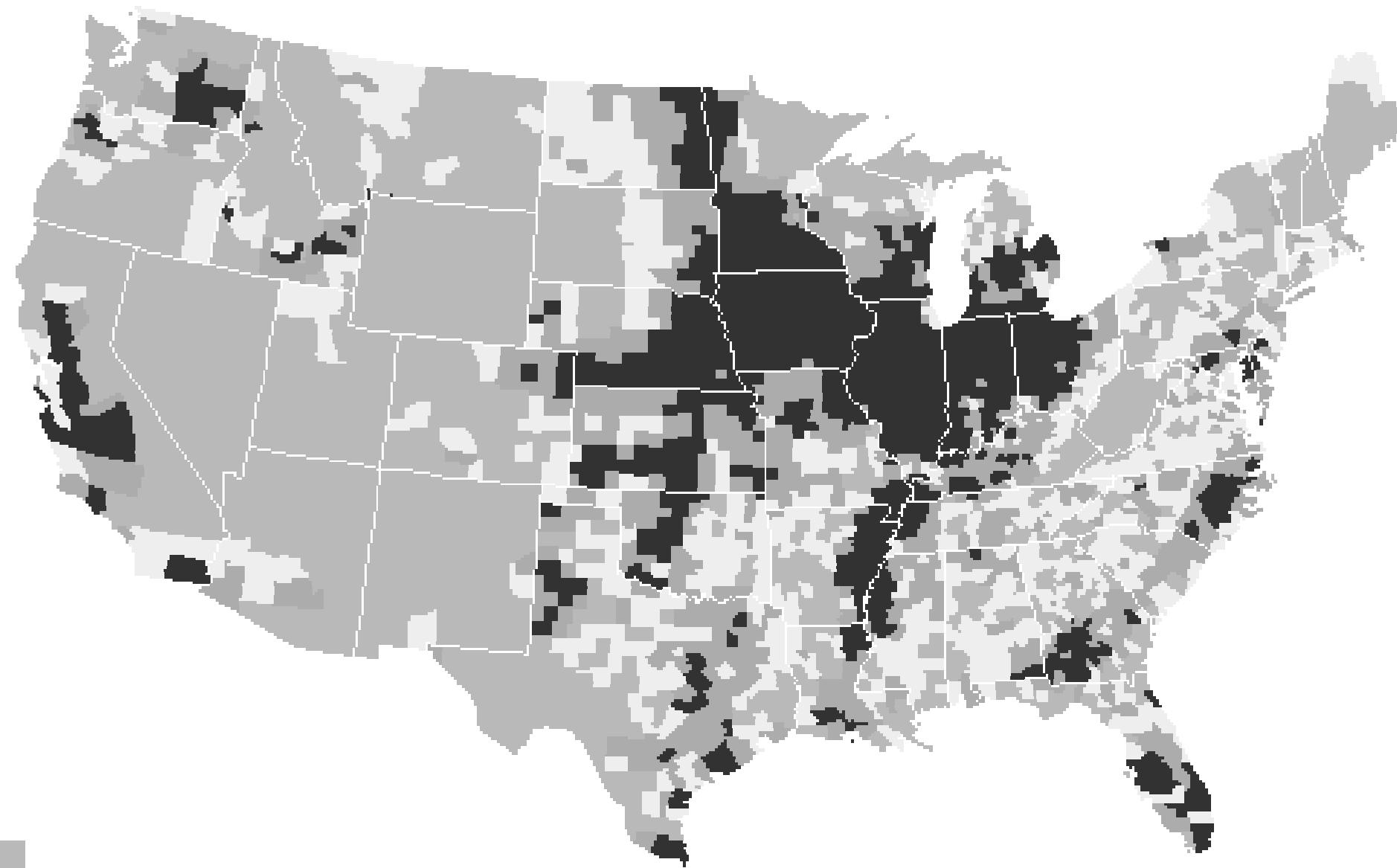
- Nitrogen and phosphorus
- Essential for life, but too much of a good thing



Nutrients -Why the concern?

- 2000 National WQ Inventory: nutrient over-enrichment impairs
 - More than 20% of rivers
 - 50% of lakes
 - Agriculture reported as largest source of nutrient impairment
- Hypoxic zone in the Gulf and mid-Atlantic coast Pfisteria outbreaks - linked to nutrient over-enrichment

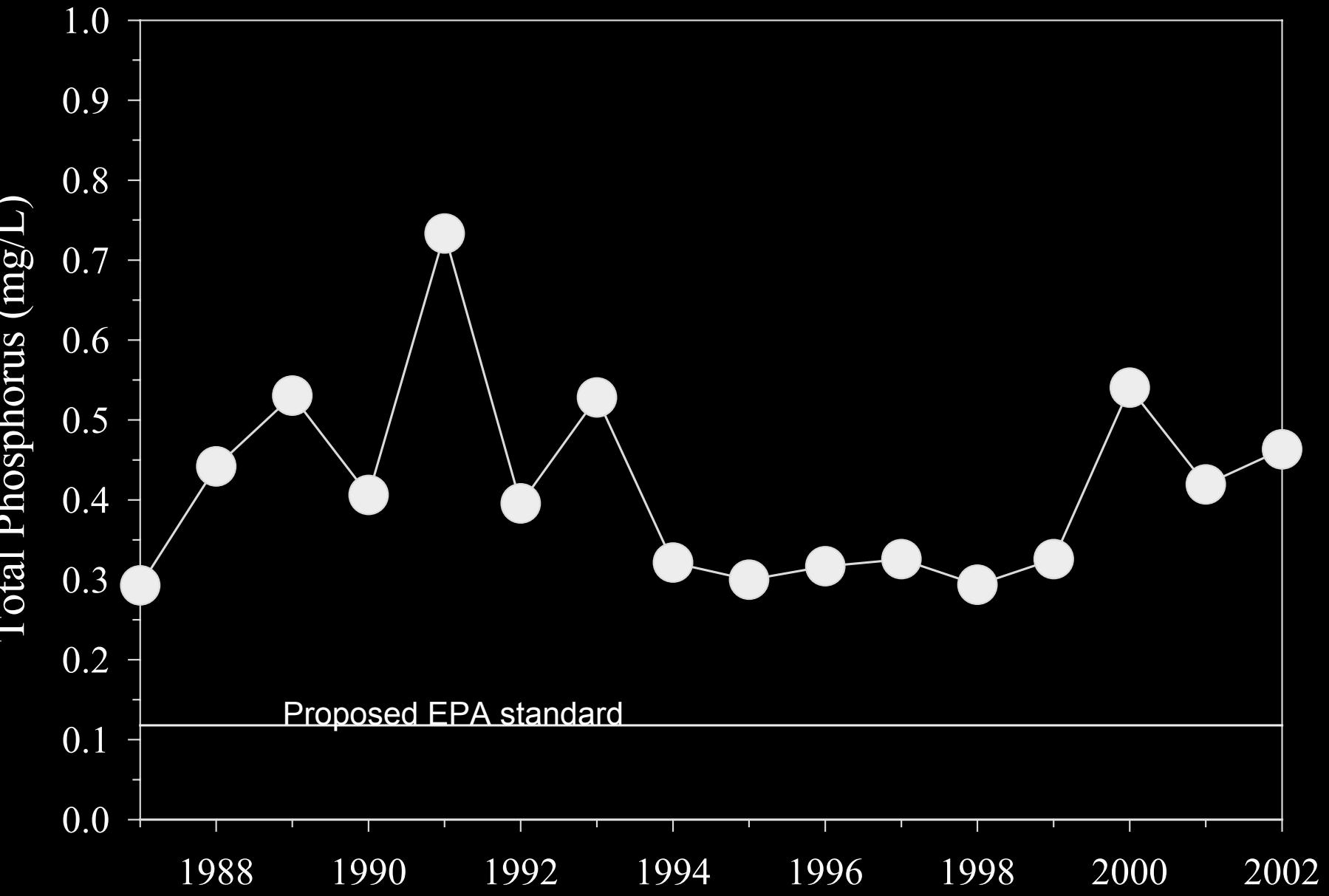




Nutrients -Why the concern?

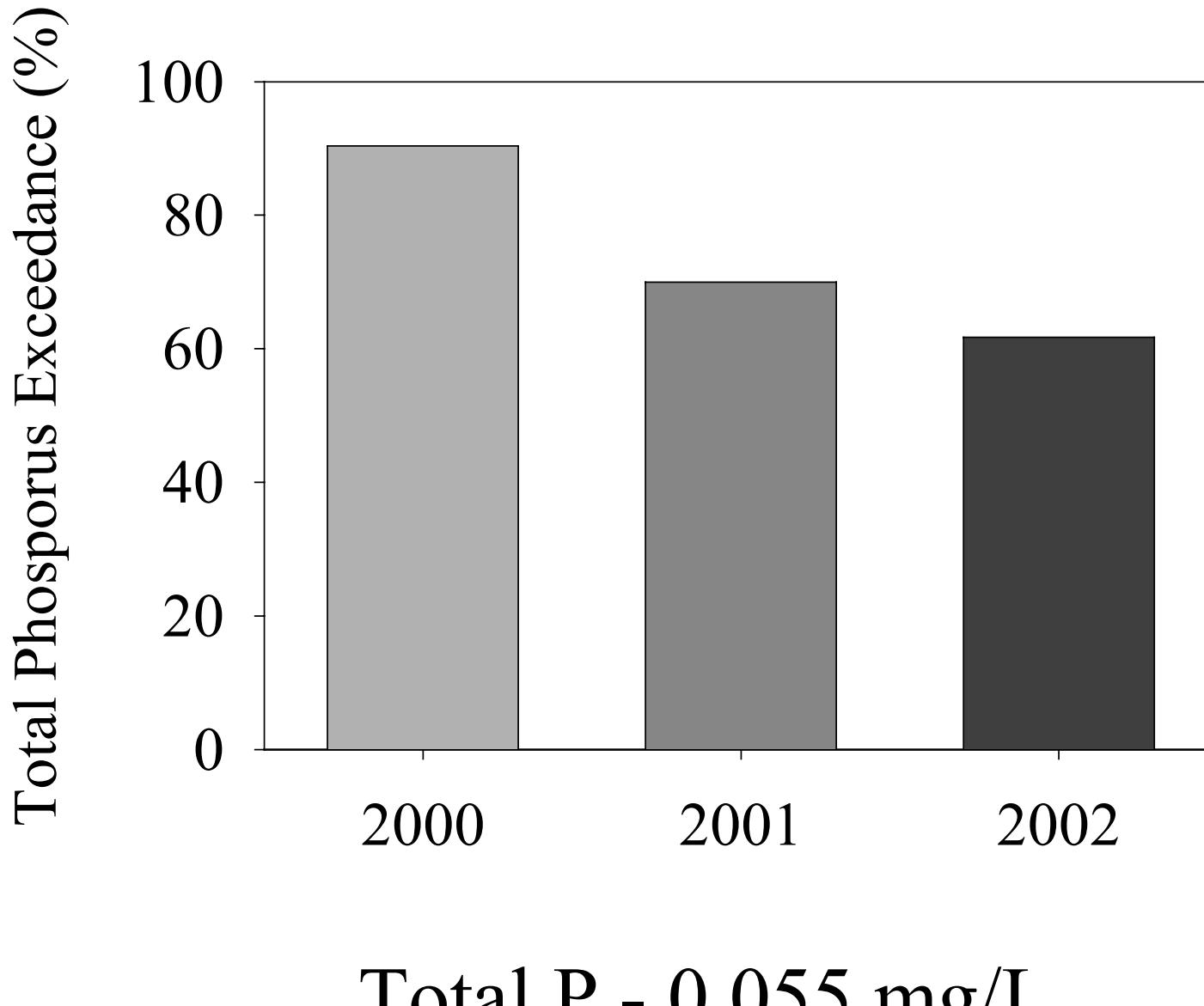
- Algae and aquatic vegetation
 - Nuisance
 - toxic algae
- Low oxygen levels
- Increased turbidity
- High nitrate levels in drinking water
- Disinfection by-products in drinking water that can cause cancer
- Imbalance of aquatic species





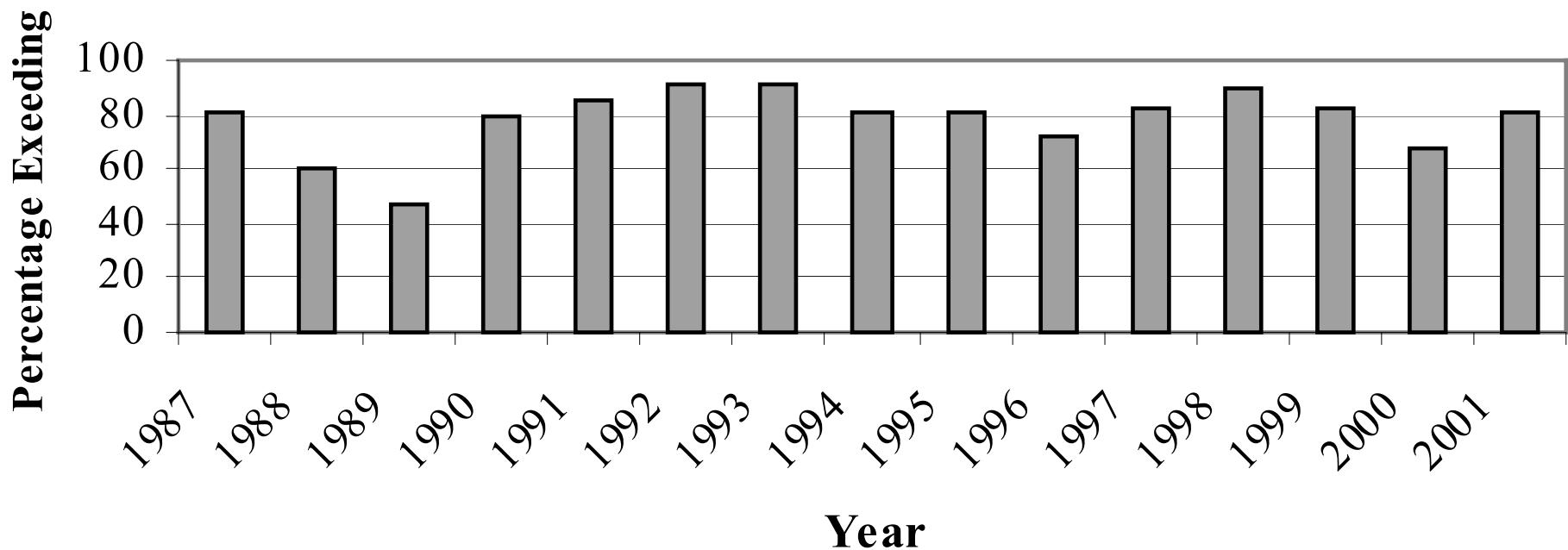
Ambient Monitoring Lake Data

2000 - 2002



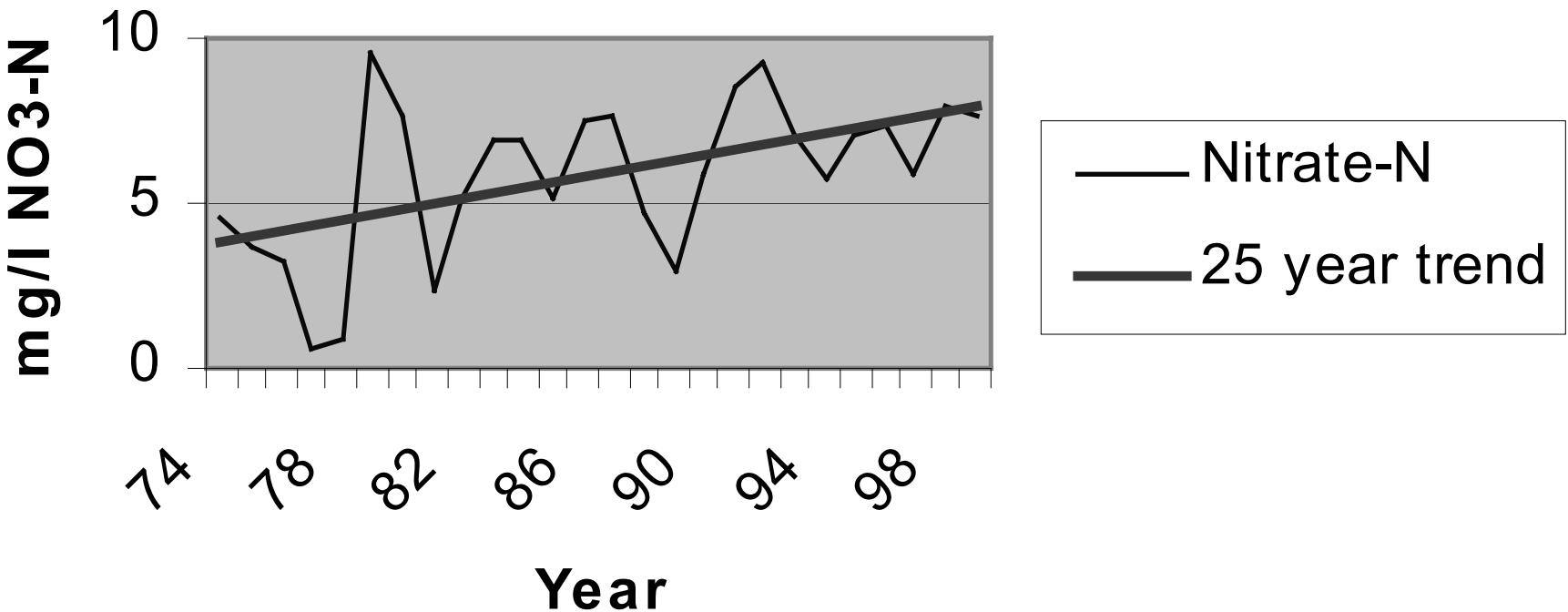
Total Nitrogen in Streams

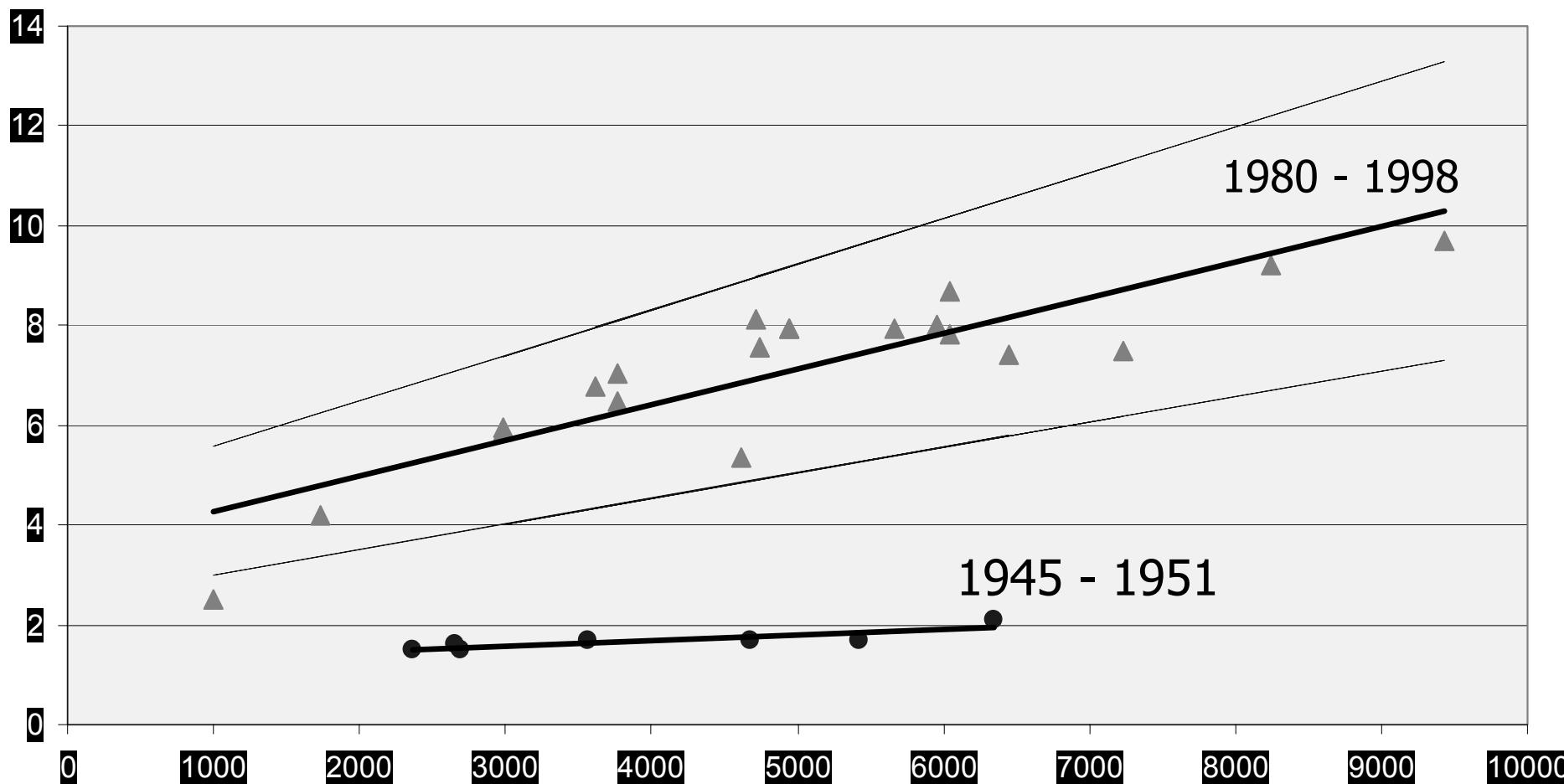
**Percentage of Stream Samples Exceeding Proposed Total
Nitrogen Standard (Sixteen Long-term Sites)**



DM Water Works NO₃ Data

Annual Average for Raccoon River





Statewide Groundwater Contamination (SWRL, 1988-1989)

Private Drinking Water Wells	Nitrate – N Above 10 mg/l	Pesticide Detections
< 50 Feet Deep	35.1%	17.9%
> 50 Feet Deep	12.8%	11.7%
All Wells	18.3%	13.6%

Comprehensive Nutrient Strategy

- Where does the nitrogen and phosphorus in our waters come from?
- What can Iowa do to reduce the levels in water?

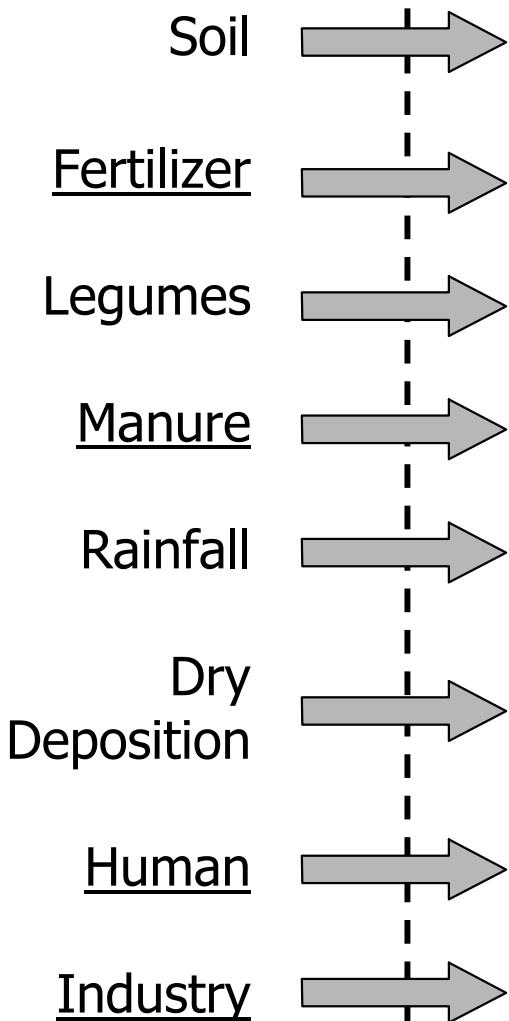
Iowa Nutrient Strategy

- Develop nutrient budget
- Assess technologies to reduce nutrients
- Assess impacts on water & environment
- Assess economic impacts
- Develop water quality standards
- Identify alternatives/develop consensus

Nutrient Budget

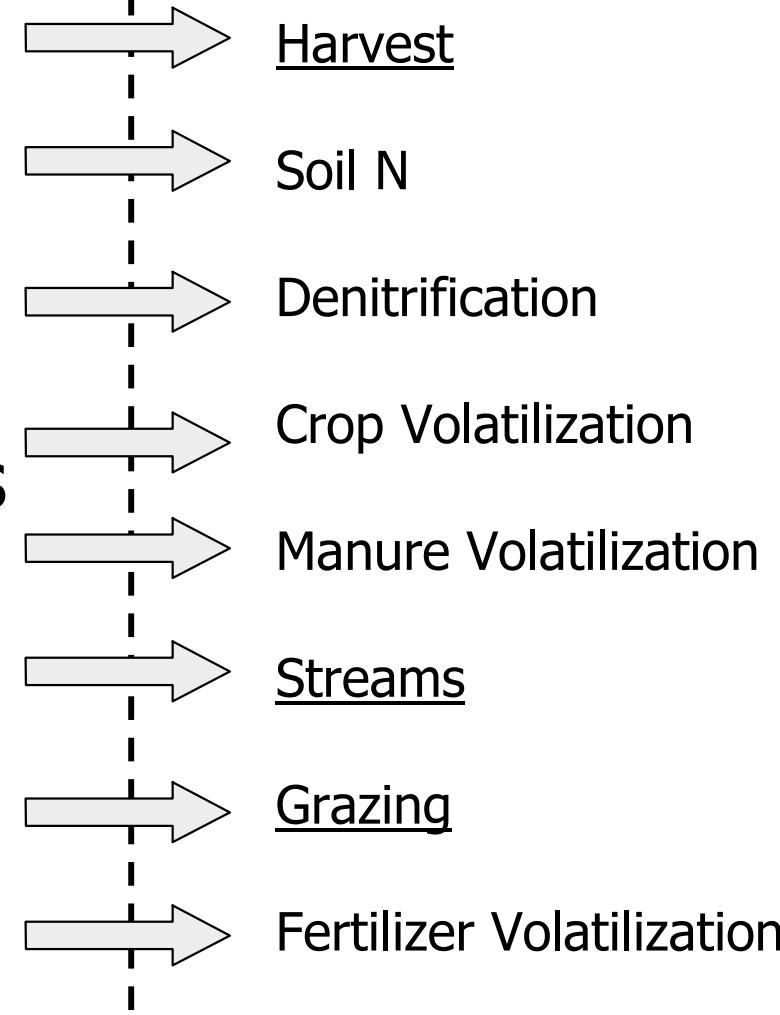
Inputs

Outputs

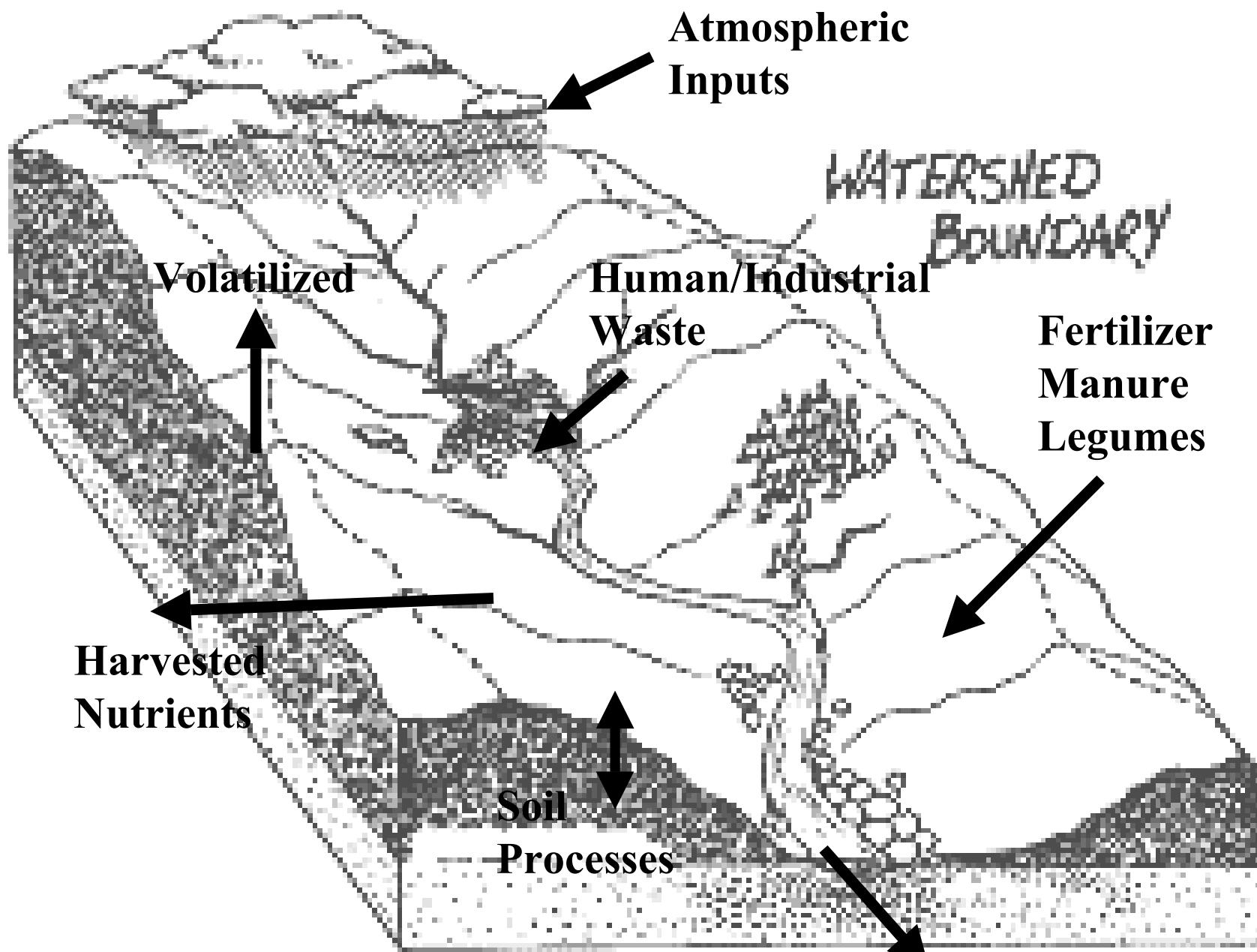


Entire State

68 Watersheds



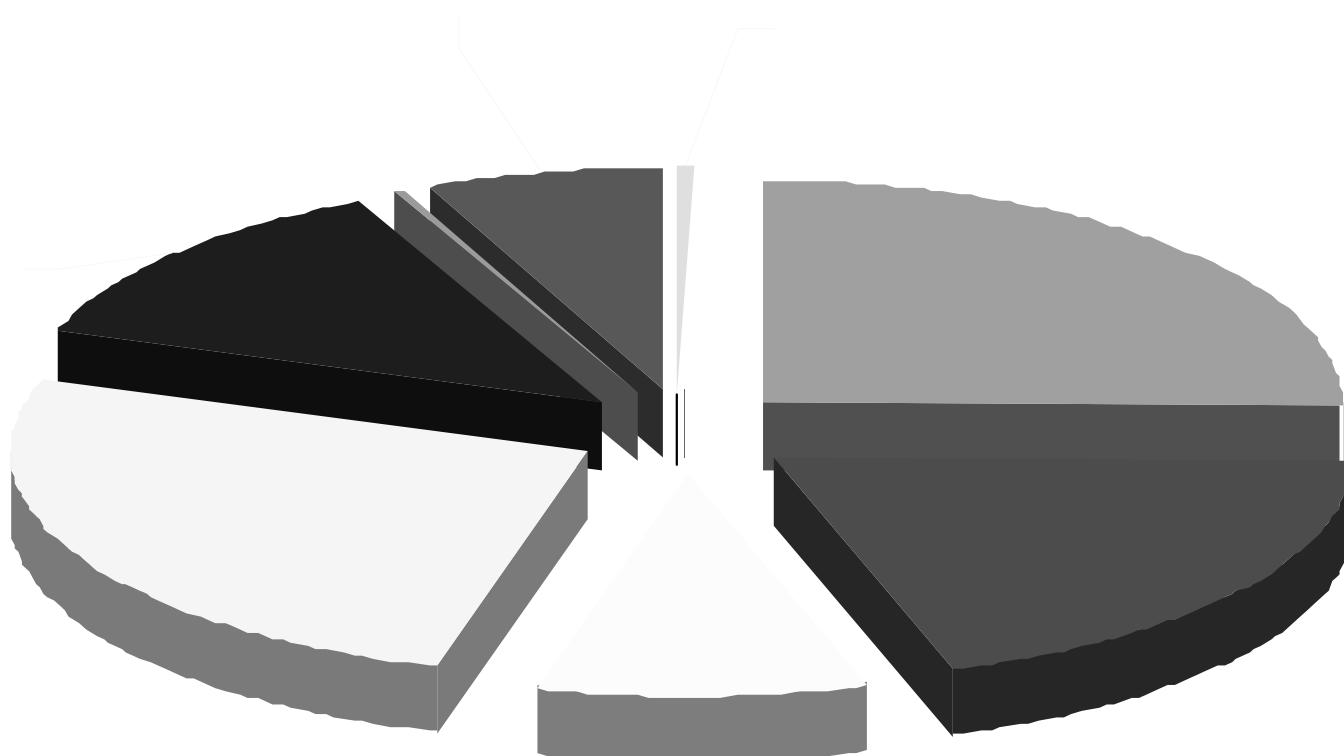
What is a Nutrient Budget?



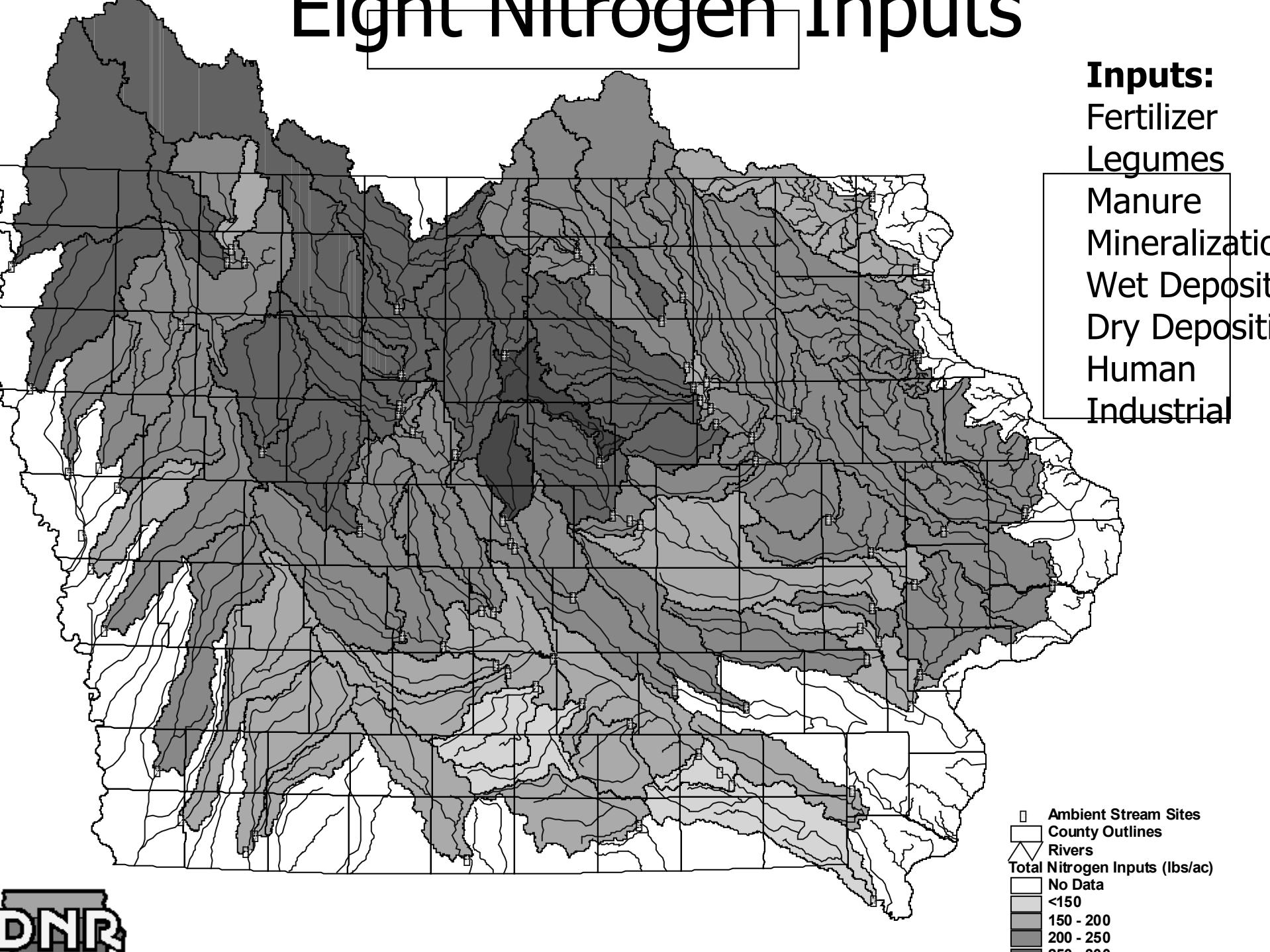
Nutrient Budget

- First for Iowa
- Estimates based upon most acceptable data sets and 'average' values
- Data allocated using GIS procedures
- There is some uncertainty associated with these estimates

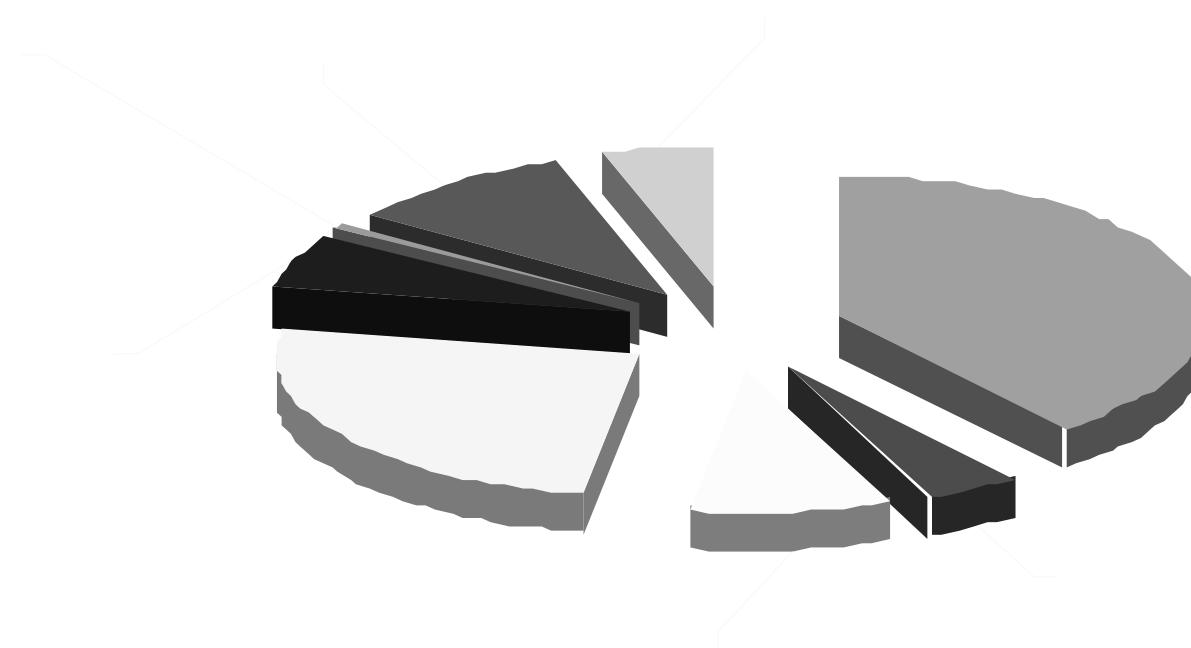
Nutrient Budget – Nitrogen Inputs



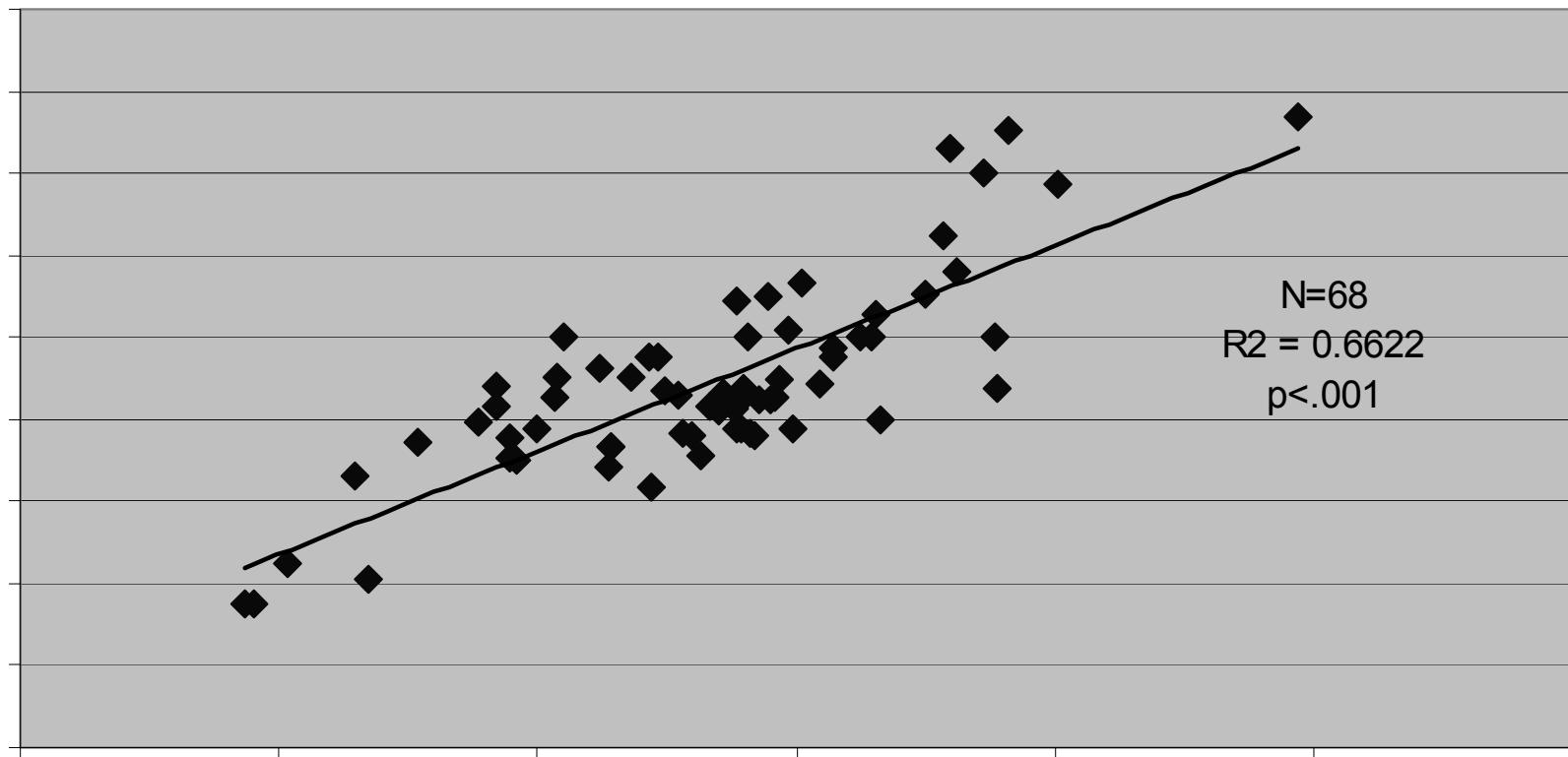
Eight Nitrogen Inputs



Nutrient Budget – Nitrogen Outputs



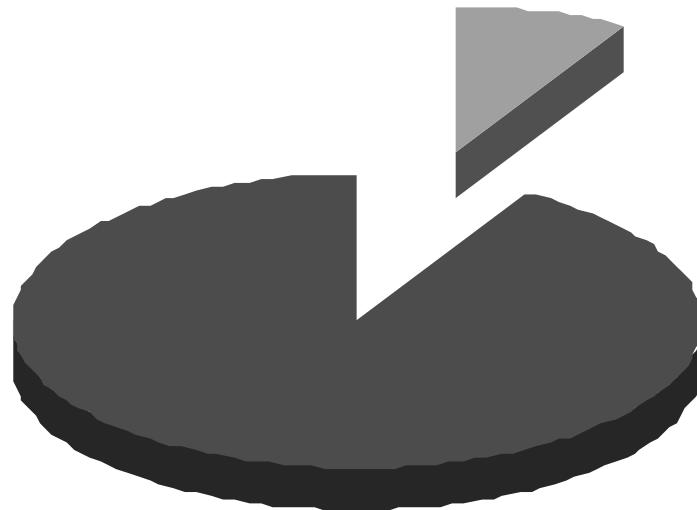
Total N Inputs per Basin vs. Total N Stream Concentration



Identification of Sources

- Point
 - Human
 - Industrial
- Non-point
 - Fertilizer
 - Legumes
 - Manure
 - Mineralized soil N
 - Wet and dry deposition

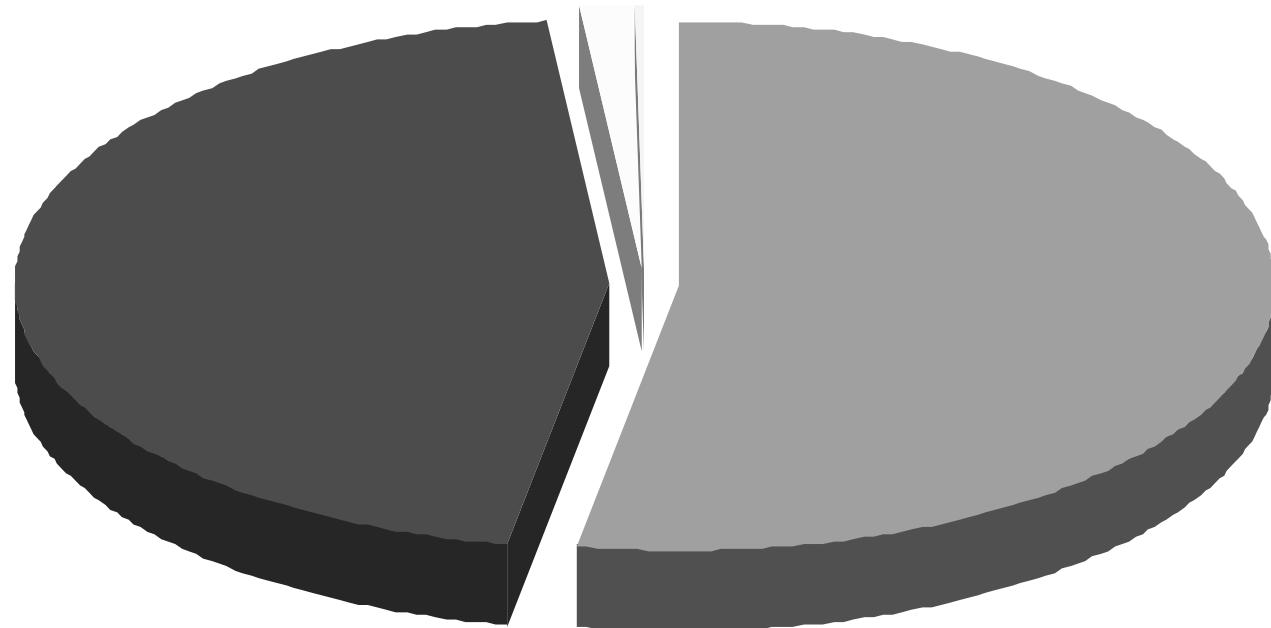
Estimated Point & Non-point Source Contributions to Stream N-Load



Nitrogen - preliminary results

- Large amount of nitrogen in watersheds; N released to water is a very small percentage of available N
- N level found in waters is related to total N inputs
- Point sources - 8% of N in streams
- Non-point sources - 92% of N in streams

Phosphorus Inputs



Four Phosphorus Inputs

